

EVALUATION THE RELATIONSHIP BETWEEN UKRAINIAN RAPESEED PRICES AND CRUDE OIL PRICES

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Abstract. *In the article is analysed the linkage between Ukrainian rapeseed prices and crude oil prices. To find such connection dynamic causal model was implied, where results stated that by the change on 1% of oil prices, Ukrainian rapeseed prices change by 0.01%. One of the factor that determines the relationship among agricultural and energy market is biofuel development worldwide that is considered in the paper.*

Forecast of Ukrainian rapeseed prices showed that these prices will slightly fluctuate and increasing until the December 2018, which is quite possible due to the turbulence situation on agricultural markets.

Key words: *rapeseed prices, crude oil prices, dynamic causal model, biofuels, forecast*

Introduction. Market for mineral fuel much more than the market of food and feed, as the need for biofuel production in the future could create a large demand for grains, sugar and oilseeds that will lead to higher prices for food crops.

Trends that we could observe in the global oil market forced many governments to develop alternative energy sources, including biological fuels. The presence of biological fuels in the energy balance of each country is becoming more relevant issue in the context of energy and environmental safety. Thus, agriculture plays an important role in sourcing raw materials not only for food, but for the energy sector that could directly affect agricultural production, and hence food prices.

World production and use of biofuels have reached a high level of growth, which influenced not only the development of the industry, but the number of countries that are rapidly being included in this sphere. Investment attractiveness of biofuel production is stimulated by the influence of such factors as: the development of effective technologies, government programs, and instability of oil prices and their exhausting in the future. As a result, for agriculture there are new markets for products, partially reduced dependence

on imported mineral fuel prices and according to it, increasing the positive impact on the environment.

Analysis of recent researches and publications. The main factor underlying price linkage between agricultural and crude oil markets is physical demand for rapeseeds for biofuel production, i.e. biodiesel, and physical demand for oil from agriculture. The latter is related to cost side as input and is rather stable over time.

Many scientists are researched such relationships between oil, biofuel, agriculture and food. Combination of high and rising fuel prices coupled with between petroleum prices and food prices [2, 5, 7]. Patton et al. examined the extent to which price volatility in the energy sector is transmitted to the biofuel and agricultural sectors[8].

Hertel and Beckman analyzed the linkages between energy and agricultural markets under different policy regimes[6]. They examined how energy price volatility has been transmitted to commodity prices, and how changes in energy policy regimes affect the inherent volatility of commodity prices in response to traditional supply-side shocks.

The various interactions between agricultural and energy markets and their environmental impacts for existing biomass crops and detail how these interactions may be strengthened taking into account feedstock production for the second generation biofuel were researched by Dodder et al. [3].

The literature review indicates that, in recent years, changes in the agriculture sector's relationship with energy - both using energy as an input into agricultural production and supplying agricultural feedstocks for use in biofuel production [1].

Hence, literature review indicate the existence of the linkage between energy and agricultural markets in different economies condition worldwide and commodity markets, as well as using different methodology to research it.

Purpose. Taking into consideration the above mentioned researches of the problem, this article is focused on statistical investigation of the dependence between world oil prices and rapeseed prices on Ukrainian market.

Methods. To analyze the linkage between Ukrainian rapeseed and oil prices dynamic causal method was applied. The dynamic models allow to study causality between two or more variables, not just correlation as in the case of the static models. For this reason the dynamic models are used for the agricultural price forecasting. Using dynamic model contains lagged forecasted variable and lagged explanatory variables. This means that the commodity price is a function of the current and lagged values of exogenous variables and the lagged values of endogenous variables. The model with one explanatory variable X and lags in endogenous and exogenous variables can be written as follows (formula (1)) [4]:

$$Y_t = f(Y_{t-1}, Y_{t-2}, \dots, Y_{t-p}, X_t, X_{t-1}, X_{t-2}, \dots, X_{t-q}, \varepsilon_t), \quad (1)$$

where Y_{t-p} – lagged endogenous variable in time $t-p$, $i=1,2,\dots,p$,
 X_{t-q} – lagged exogenous variables in time $t-q$, $i=1,2,\dots,q$.

Models with lags are more suitable in practical applications of commodity price forecasting. In order to assess the estimation method accuracy and the usefulness of a given model in the forecast construction, the following elements should be taken into account: 1) assess a randomness of residuals the Wald-Wolfowitz runs test is used; evaluate autocorrelation based on the Durbin-Watson test.

Results. Many scientists have convinced that due to development of the biofuel market, the linkage between prices on agricultural commodities and crude oil will be getting stronger. However, individual research results differ depending on the applied methods. In Ukraine rapeseeds are produced mainly for export, e.g. in 2017 approximately 90% was exported and only 9% was processed inside the country. If the world rapeseed prices are related to the crude oil prices, it may also be expected that there is a linkage between Ukrainian rapeseed prices and crude oil prices.

The analysis of the linkage between Ukrainian rapeseed prices and crude oil world prices described in the article, used monthly series from January 2016 to January 2018, according to OPEC data for oil and to Ukrainian source APK inform for rape seed prices.

Normally the crude oil prices largely influence on agriculture prices; thus using the dynamic causal model could present the relationship.

The model for Ukrainian rapeseed has such the form presented in the table 1 and shows the linkage between crude oil prices and rapeseed prices in Ukraine. As we can see on data in the table variables $\ln X_t$ and $\ln X_{(t-1)}$ are significant and influence on the Ukrainian rapeseed prices, where $\ln Y_{(t-1)}$ is not the important for the model. In this case, it is property true and therefore the sum of the oil prices coefficients show us that a 1% of oil prices influences Ukrainian rapeseed prices change by 0.01%.

Assessing randomness of the residuals we have calculated Z statistics, which equals to -0.88 that is lower than critical value 2. Z-test supports the fact that errors are normally distributed.

Durbin-Watson statistic equals to 1.7. The fact that $2 > 1,7 > d_2$ indicates there is statistical evidence that the error terms are not positively autocorrelated.

1. Model for Ukrainian rapeseed

Variable	Coefficient	P-Value
a0	3,497915	0,007147
$\ln Y_{t-1}$	0,370037	0,103101
$\ln X_t$	0,28293	0,008902
$\ln X_{t-1}$	-0,20323	0,033432

Source: authors' calculation.

The future value of forecasted phenomenon was obtained through an extrapolation of the trend function based on Holt's method. The figure 1 shows that prices for Ukrainian rapeseed in forecast period will increase and in December 2018 could reach the level of 461 USD/t.

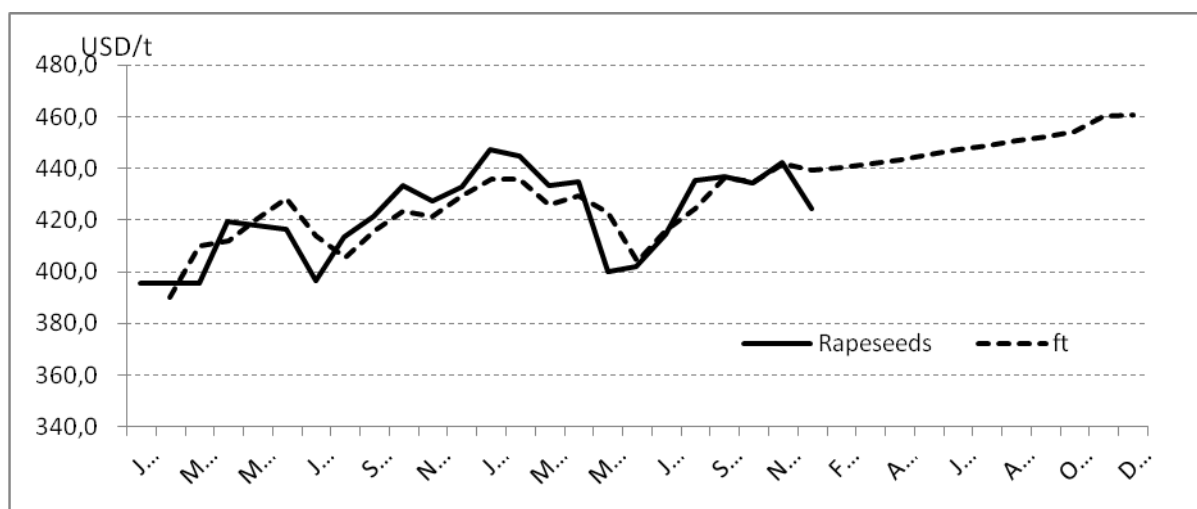


Figure 1. Forecast of Ukrainian rapeseed prices series based on Holt's method

Thus, implemented evaluation of the linkage between Ukrainian rapeseed prices and crude oil prices is obvious, however is not strong. Forecasting of rapeseed prices is shifted on high value over the forecast period that could explain by included crude oil variables, which prices is going up.

Conclusions and perspectives. To forecast the Ukrainian prices we have used the dynamic causal model. Moreover, in order to forecast independent variables, which are included in this model – monthly prices of rapeseed in Ukraine and crude oil prices – we have used Holt's method. These models also show good level of fitness and low level of errors, which means, that they reflecting our data's possible future development quite reasonably. Multiple coefficient of the model equals 0.79 that means tight correlation between included variables. Determination coefficient amounted 0.62, meaning that rapeseed prices on 62% fluctuate from crude oil prices in t and t-1 periods.

Analyzing given forecasts, we may conclude, that rapeseed prices in Ukraine we might suppose, that this prices will slightly fluctuate increasing until the December 2018, which is quite possible due to the situation on agricultural market.

Further research will address the impact of various factors on agricultural products and provide guidance for macro-level management decisions.

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ОЦЕНКА ВЗАИМОСВЯЗИ ЦЕН НА РАПС В УКРАИНЕ С МИРОВЫМИ ЦЕНАМИ НА НЕФТЬ

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***Аннотация.** В статье проанализовано связь между ценами на рапс в Украине и ценами на нефть. Для выявления такой связи было использовано динамическую причинную модель, результаты которой показали, что с изменением на 1 % цен на нефть, цены на украинский рапс изменятся на 0,01 %. Одним из факторов, который определяет взаимосвязь между сельскохозяйственным и энергетическим рынками, является развитие биотоплива в мире, влияние которого обоснованно в статье.*

Прогноз украинских цен на рапс показал, что данные цены несколько возрастут до декабря 2018 года, что вполне возможно из-за ситуации с нестабильностью на сельскохозяйственных рынках.

***Ключевые слова:** цены на рапс, цены на нефть, динамическая причинная модель, биотопливо, прогноз*

ОЦІНКА ВЗАЄМОЗВ'ЯЗКУ ЦІН НА РІПАК В УКРАЇНІ ЗІ СВІТОВИМИ ЦІНАМИ НА НАФТУ

О. Г. Макаrchук, Я. Скудларски

***Анотація.** У статті проаналізовано зв'язок між цінами на ріпак в Україні та цін на нафту. Для виявлення такого зв'язку було використано динамічну причинну модель, результати якої показали, що зі зміною на 1% цін на нафту, ціни на український ріпак зміняться на 0,01%. Одним із чинників, який визначає взаємозв'язок між сільськогосподарським та енергетичним ринками, є розвиток біопального у світі, вплив якого обґрунтовано в статті.*

Прогноз українських цін на ріпак засвідчив, що дані ціни дещо зростатимуть до грудня 2018 року, що цілком можливо через ситуацію з нестабільністю на сільськогосподарських ринках.

***Ключові слова:** ціни на ріпак, ціни на нафту, динамічна причинна модель, біопальне, прогноз*